Part I: Description of Overall Test Plan

The testing we are doing for G.E.M.S is designed to thoroughly check our system's functionality, reliability, and performance. The tests are split up into two phases:

1. Unit Testing: Each module of our system will be tested independently using either normal or abnormal test cases. This employs the model-driven test design methodology to verify functionality before integration into the system.
2. Integration Testing: Once phase one is complete, we will look into integration testing to make sure that all the modules interact properly and without faults. This phase will have an emphasis on compatibility and performance.

We plan to have the test cases designed using a blackbox testing approach. We will have a set of expected outcomes or requirements that need to be completed in order to move forward. We will also use whitebox testing to make sure our logical operations are implemented properly. Some other test cases include seeing how the system will handle varying levels of traffic to the database and application. Once functional testing between the two phases is complete, we should have a compliant and expo-ready system to showcase.

Part II: Test Case Descriptions

TC1.1 - User Login Test

- **Purpose:** Verify that users can successfully log into the system with valid credentials.
- **Description:** A user enters a valid username and password on the login page.
- **Inputs:** Valid username and password.
- **Expected Outputs:** User is authenticated and redirected to the dashboard.
- **Type:** Normal Case, Blackbox, Functional, Unit Test

TC1.2 - Invalid Login Attempt

- **Purpose:** Ensure that the system rejects incorrect login credentials.
- **Description:** A user attempts to log in with an incorrect password.
- **Inputs:** Valid username, incorrect password.
- **Expected Outputs:** Authentication fails, displaying an error message.
- **Type:** Abnormal Case, Blackbox, Functional, Unit Test

TC2.1 - Page Navigation Test

- **Purpose:** Verify that all pages are accessible to all users.
- **Description:** A user navigates to various pages.
- **Inputs:** Valid Session.

- **Expected Outputs:** All pages load without errors.
- **Type:** Normal Case, Blackbox, Functional, Unit Test

TC2.2 - Unauthorized Page Access

- **Purpose:** Ensure that non-authenticated users cannot access restricted pages.
- **Description:** A user tries to access a restricted page without logging in.
- **Inputs:** Direct URL entry.
- **Expected Outputs:** The system redirects to the login page.
- **Type:** Abnormal Case, Blackbox, Functional, Unit Test

TC3.1 - System Load Test

- **Purpose:** Measure system performance under high user load.
- **Description:** Simulate multiple users logging in and performing actions.
- **Inputs:** Concurrent user sessions.
- **Expected Outputs:** System remains stable and responsive.
- **Type:** Normal Case, Blackbox, Performance, Integration Test

TC3.2 - Database Stress Test

- **Purpose:** Evaluate database performance under heavy transaction loads.
- **Description:** Execute high-volume database queries.
- **Inputs:** Large dataset transactions.
- **Expected Outputs:** Queries execute within acceptable time limits.
- **Type:** Normal Case, Whitebox, Performance, Integration Test

TC4.1 - API Response Test

- **Purpose:** Ensure that the system API responds correctly to requests.
- **Description:** Call API endpoints with expected parameters.
- **Inputs:** API requests.
- **Expected Outputs:** Correct JSON responses.
- **Type:** Normal Case, Blackbox, Functional, Integration Test

TC4.2 - API Security Test

- **Purpose:** Validate that unauthorized API requests are rejected.
- **Description:** Send API requests without authentication tokens.
- **Inputs:** Unauthorized API requests.
- **Expected Outputs:** Authentication failure response.
- **Type:** Abnormal Case, Blackbox, Functional, Integration Test

TC5.1 - AI Timing System Test

- **Purpose:** Ensure the AI system correctly checks gym equipment usage at regular intervals.
- **Description:** The AI system should check every "blank" amount of time to detect equipment usage and update the database.
- **Inputs:** Simulated time intervals and gym equipment usage scenarios.
- **Expected Outputs:** AI logs usage status into the database at the correct intervals.
- **Type:** Normal Case, Blackbox, Functional, Integration Test

TC5.2 - AI Detection Test (Bench)

- **Purpose:** Validate that the AI correctly identifies a bench.
- **Description:** AI processes images to detect a bench in the gym.
- **Inputs:** Images with and without a bench.
- **Expected Outputs:** Correct identification of the bench.
- **Type:** Normal Case, Blackbox, Performance Test, Unit Test

TC5.3 - AI Detection Test (Benchpress)

- **Purpose:** Validate that the AI correctly identifies a bench press setup.
- **Description:** AI processes images to detect a bench press.
- **Inputs:** Images with and without a bench press.
- **Expected Outputs:** Correct identification of the bench press.
- **Type:** Normal Case, Blackbox, Performance Test, Unit Test

TC5.4 - AI Detection Test (Treadmill)

- **Purpose:** Validate that the AI correctly identifies a treadmill.
- **Description:** AI processes images to detect a treadmill in the gym.
- **Inputs:** Images with and without a treadmill.
- **Expected Outputs:** Correct identification of the treadmill.
- **Type:** Normal Case, Blackbox, Performance Test, Unit Test

TC5.5 - AI Detection Test (Person)

- **Purpose:** Validate that the AI correctly detects a person using gym equipment.
- **Description:** AI processes images to identify if a person is using the equipment.
- **Inputs:** Images with and without a person present.
- **Expected Outputs:** Correct identification of a person using the equipment.
- **Type:** Normal Case, Blackbox, Performance Test, Unit Test

Part III: Test Case Matrix

Test Case	Normal/ Abnormal	Blackbox/ Whitebox	Functional/ Performance	Unit/ Integration
TC 1.1	Normal	Blackbox	Functional	Unit
TC 1.2	Abnormal	Blackbox	Functional	Unit
TC 2.1	Normal	Blackbox	Functional	Unit
TC 2.2	Abnormal	Blackbox	Functional	Unit
TC 3.1	Normal	Blackbox	Performance	Integration
TC 3.2	Normal	Whitebox	Performance	Integration
TC 4.1	Normal	Blackbox	Functional	Integration
TC 4.2	Abnormal	Blackbox	Functional	Integration
TC 5.1	Normal	Blackbox	Functional	Integration
TC 5.2	Normal	Blackbox	Performance	Unit
TC 5.3	Normal	Blackbox	Performance	Unit
TC 5.4	Normal	Blackbox	Performance	Unit
TC 5.5	Normal	Blackbox	Performance	Unit

This test plan ensures that key functionalities, security, and performance aspects of the system are thoroughly verified. Further refinements and additional test cases may be incorporated based on project needs and development progress.